



ATTORNEY DOCKET NO. 07121.0003U1

SEQUENCE LISTING

<110> Sung, Wing
<120> Xylanases with Enhanced Thermophilicity and Alkalophilicity
<130> 07121.0003U1
<140> 09/990,874
<141> 2001-11-21
<160> 71
<170> PatentIn version 3.0
<210> 1
<211> 184
<212> PRT
<213> Aspergillus niger

<400> 1

Ser	Ala	Gly	Ile	Asn	Tyr	Val	Gln	Asn	Tyr	Asn	Gly	Asn	Leu	Gly	Asp
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			20					25					30		
Gly	Val	Ser	Ser	Asp	Phe	Val	Val	Gly	Leu	Gly	Trp	Thr	Thr	Gly	Ser
		35					40					45			
Ser	Asn	Ala	Ile	Thr	Tyr	Ser	Ala	Glu	Tyr	Ser	Ala	Ser	Gly	Ser	Ser
	50					55					60				
Ser	Tyr	Leu	Ala	Val	Tyr	Gly	Trp	Val	Asn	Tyr	Pro	Gly	Ala	Glu	Tyr
65				70					75					80	
Tyr	Ile	Val	Glu	Asp	Tyr	Gly	Asp	Tyr	Asn	Pro	Cys	Ser	Ser	Ala	Thr
			85					90						95	
Ser	Leu	Gly	Thr	Val	Tyr	Ser	Asp	Gly	Ser	Thr	Tyr	Gln	Val	Cys	Thr
			100					105					110		
Asp	Thr	Arg	Ile	Asn	Glu	Pro	Ser	Ile	Thr	Gly	Thr	Ser	Thr	Phe	Thr
		115					120					125			
Gln	Tyr	Phe	Ser	Val	Arg	Glu	Ser	Thr	Arg	Thr	Ser	Gly	Thr	Val	Thr
		130				135					140				
Val	Ala	Asn	His	Phe	Asn	Phe	Trp	Ala	Gln	His	Gly	Phe	Gly	Asn	Ser
145				150						155				160	
Asp	Phe	Asn	Tyr	Gln	Val	Met	Ala	Val	Glu	Ala	Trp	Ser	Gly	Ala	Gly
				165					170					175	

Ser Ala Ser Val Thr Ile Ser Ser
180

<210> 2

<211> 185

<212> PRT

<213> *Aspergillus tubigensis*

<400> 2

Ser Ala Gly Ile Asn Tyr Val Gln Asn Tyr Asn Gln Asn Leu Gly Asp
1 5 10 15

Phe Thr Tyr Asp Glu Ser Ala Gly Thr Phe Ser Met Tyr Trp Glu Asp
20 25 30

Gly Val Ser Ser Asp Phe Val Val Gly Leu Gly Gly Trp Thr Thr Gly
35 40 45

Ser Ser Asn Ala Ile Thr Tyr Ser Ala Glu Tyr Ser Ala Ser Gly Ser
50 55 60

Ala Ser Tyr Leu Ala Val Tyr Gly Trp Val Asn Tyr Pro Gln Ala Glu
65 70 75 80

Tyr Tyr Ile Val Glu Asp Tyr Gly Asp Tyr Asn Pro Cys Ser Ser Ala
85 90 95

Thr Ser Leu Gly Thr Val Tyr Ser Asp Gly Ser Thr Tyr Gln Val Cys
100 105 110

Thr Asp Thr Arg Ile Asn Glu Pro Ser Ile Thr Gly Thr Ser Thr Phe
115 120 125

Thr Gln Tyr Phe Ser Val Arg Glu Ser Thr Arg Thr Ser Gly Thr Val
130 135 140

Thr Val Ala Asn His Phe Asn Phe Trp Ala His His Gly Phe His Asn
145 150 155 160

Ser Asp Phe Asn Tyr Gln Val Val Ala Val Glu Ala Trp Ser Gly Ala
165 170 175

Gly Ser Ala Ala Val Thr Ile Ser Ser
180 185

<210> 3

<211> 185

<212> PRT

<213> *Bacillus circulans*

<400> 3

Asn Ala Val Asn Gly Ser Gly Gly Asn Tyr Ser Val Asn Trp Ser Asn
20 25 30

Thr Gly Asn Phe Val Val Gly Lys Gly Trp Thr Thr Gly Ser Pro Phe
35 40 45

Arg Thr Ile Asn Tyr Asn Ala Gly Val Trp Ala Pro Asn Gly Asn Gly
50 55 60

Tyr Leu Thr Leu Tyr Gly Trp Thr Arg Ser Pro Leu Ile Glu Tyr Tyr
65 70 75 80

Val Val Asp Ser Trp Gly Thr Tyr Arg Pro Thr Gly Thr Tyr Lys Gly
85 90 95

Thr Val Lys Ser Asp Gly Gly Thr Tyr Asp Ile Tyr Thr Thr Thr Arg
100 105 110

Tyr Asn Ala Pro Ser Ile Asp Gly Asp Arg Thr Thr Phe Thr Gln Tyr
115 120 125

Trp Ser Val Arg Gln Ser Lys Arg Pro Thr Gly Ser Asn Ala Thr Ile
130 135 140

Thr Phe Thr Asn His Val Asn Ala Trp Lys Ser His Gly Met Asn Leu
145 150 155 160

Gly Ser Asn Trp Ala Tyr Gln Val Met Ala Thr Glu Gly Tyr Gln Ser
165 170 175

Ser Gly Ser Ser Asn Val Thr Val Trp
180 185

<210> 4

<211> 201

<212> PRT

<213> Bacillus pumilus

<400> 4

Arg Thr Ile Thr Asn Asn Glu Met Gly Asn His Ser Gly Tyr Asp Tyr
1 5 10 15

Glu Leu Trp Lys Asp Tyr Gly Asn Thr Ser Met Thr Leu Asn Asn Gly
20 25 30

Gly Ala Phe Ser Ala Gly Trp Asn Asn Ile Gly Asn Ala Leu Phe Arg
35 40 45

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Lys Gly Lys Lys Phe Asp Ser Thr Arg Thr His His Gln Leu Gly Asn
50 55 60

Ile Ser Ile Asn Tyr Asn Ala Ser Phe Asn Pro Ser Gly Asn Ser Tyr
65 70 75 80

Leu Cys Val Tyr Gly Trp Thr Gln Ser Pro Leu Ala Glu Tyr Tyr Ile
85 90 95

Val Asp Ser Trp Gly Thr Tyr Arg Pro Thr Gly Ala Tyr Lys Gly Ser
100 105 110

Phe Tyr Ala Asp Gly Gly Thr Tyr Asp Ile Tyr Glu Thr Thr Arg Val
115 120 125

Asn Gln Pro Ser Ile Ile Gly Ile Ala Thr Phe Lys Gln Tyr Trp Ser
130 135 140

Val Arg Gln Thr Lys Arg Thr Ser Gly Thr Val Ser Val Ser Ala His
145 150 155 160

Phe Arg Lys Trp Glu Ser Leu Gly Met Pro Met Gly Lys Met Tyr Glu
165 170 175

Thr Ala Phe Thr Val Glu Gly Tyr Gln Ser Ser Gly Ser Ala Asn Val
180 185 190

Met Thr Asn Gln Leu Phe Ile Gly Asn
195 200

<210> 5

<211> 185

<212> PRT

<213> Bacillus subtilus

<400> 5

Ala Ser Thr Asp Tyr Trp Gln Asn Trp Thr Asp Gly Gly Gly Ile Val
1 5 10 15

Asn Ala Val Asn Gly Ser Gly Gly Asn Tyr Ser Val Asn Trp Ser Asn
20 25 30

Thr Gly Asn Phe Val Val Gly Lys Gly Trp Thr Thr Gly Ser Pro Phe
35 40 45

Arg Thr Ile Asn Tyr Asn Ala Gly Val Trp Ala Pro Asn Gly Asn Gly
50 55 60

Tyr Leu Thr Leu Tyr Gly Trp Thr Arg Ser Pro Leu Ile Glu Tyr Tyr
65 70 75 80

Val Val Asp Ser Trp Gly Thr Tyr Arg Pro Thr Gly Thr Tyr Lys Gly
85 90 95

Thr Val Lys Ser Asp Gly Gly Thr Tyr Asp Ile Tyr Thr Thr Thr Arg
100 105 110

Tyr Asn Ala Pro Ser Ile Asp Gly Asp Arg Thr Thr Phe Thr Gln Tyr
115 120 125

Trp Ser Val Arg Gln Ser Lys Arg Pro Thr Gly Ser Asn Ala Thr Ile
130 135 140

Thr Phe Ser Asn His Val Asn Ala Trp Lys Ser His Gly Met Asn Leu
145 150 155 160

Gly Ser Asn Trp Ala Tyr Gln Val Met Ala Thr Glu Gly Tyr Gln Ser
165 170 175

Ser Gly Ser Ser Asn Val Thr Val Trp
180 185

<210> 6

<211> 211

<212> PRT

<213> Clostridium acetobutylicum

<400> 6

Ser Ala Phe Asn Thr Gln Ala Ala Pro Lys Thr Ile Thr Ser Asn Glu
1 5 10 15

Ile Gly Val Asn Gly Gly Tyr Asp Tyr Glu Leu Trp Lys Asp Tyr Gly
20 25 30

Asn Thr Ser Met Thr Leu Lys Asn Gly Gly Ala Phe Ser Cys Gln Trp
35 40 45

Ser Asn Ile Gly Asn Ala Leu Phe Arg Lys Gly Lys Lys Phe Asn Asp
50 55 60

Thr Gln Thr Tyr Lys Gln Leu Gly Asn Ile Ser Val Asn Tyr Asn Cys
65 70 75 80

Asn Tyr Gln Pro Tyr Gly Asn Ser Tyr Leu Cys Val Tyr Gly Trp Thr
85 90 95

Ser Ser Pro Leu Val Glu Tyr Tyr Ile Val Asp Ser Trp Gly Ser Trp
100 105 110

Arg Pro Pro Gly Gly Thr Ser Lys Gly Thr Ile Thr Val Asp Gly Gly
115 120 125

Ile Tyr Asp Ile Tyr Glu Thr Thr Arg Ile Asn Gln Pro Ser Ile Gln
130 135 140

Gly Asn Thr Thr Phe Lys Gln Tyr Trp Ser Val Arg Arg Thr Lys Arg
145 150 155 160

Thr Ser Gly Thr Ile Ser Val Ser Lys His Phe Ala Ala Trp Glu Ser
165 170 175

Lys Gly Met Pro Leu Gly Lys Met His Glu Thr Ala Phe Asn Ile Glu
180 185 190

Gly Tyr Gln Ser Ser Gly Lys Ala Asp Val Asn Ser Met Ser Ile Asn
195 200 205

Ile Gly Lys
210

<210> 7

<211> 206

<212> PRT

<213> Clostridium stercocrarium

<400> 7

Gly Arg Ile Ile Tyr Asp Asn Glu Thr Gly Thr His Gly Gly Tyr Asp
1 5 10 15

Tyr Glu Leu Trp Lys Asp Tyr Gly Asn Thr Ile Met Glu Leu Asn Asp
20 25 30

Gly Gly Thr Phe Ser Cys Gln Trp Ser Asn Ile Gly Asn Ala Leu Phe
35 40 45

Arg Lys Gly Arg Lys Phe Asn Ser Asp Lys Thr Tyr Gln Glu Leu Gly
50 55 60

Asp Ile Val Val Glu Tyr Gly Cys Asp Tyr Asn Pro Asn Gly Asn Ser
65 70 75 80

Tyr Leu Cys Val Tyr Gly Trp Thr Arg Asn Phe Leu Val Glu Tyr Tyr
85 90 95

Ile Val Glu Ser Trp Gly Ser Trp Arg Pro Pro Gly Ala Thr Pro Lys
100 105 110

Gly Thr Ile Thr Gln Trp Met Ala Gly Thr Tyr Glu Ile Tyr Glu Thr
115 120 125

Thr Arg Val Asn Gln Pro Ser Ile Asp Gly Thr Ala Thr Phe Gln Gln
130 135 140

Tyr Trp Ser Val Arg Thr Ser Lys Arg Thr Ser Gly Thr Ile Ser Val
145 150 155 160

Thr Glu His Phe Lys Gln Trp Glu Arg Met Gly Met Arg Met Gly Lys
165 170 175

Met Tyr Glu Val Ala Leu Thr Val Glu Gly Tyr Gln Ser Ser Gly Tyr
180 185 190

Ala Asn Val Tyr Lys Asn Glu Ile Arg Ile Gly Ala Asn Pro
195 200 205

<210> 8

<211> 211

<212> PRT

<213> Ruminococcus flavefaciens

<400> 8

Ser Ala Ala Asp Gln Gln Thr Arg Gly Asn Val Gly Gly Tyr Asp Tyr
1 5 10 15
Glu Met Trp Asn Gln Asn Gly Gln Gly Gln Ala Ser Met Asn Pro Gly
20 25 30
Ala Gly Ser Phe Thr Cys Ser Trp Ser Asn Ile Glu Asn Phe Leu Ala
35 40 45
Arg Met Gly Lys Asn Tyr Asp Ser Gln Lys Lys Asn Tyr Lys Ala Phe
50 55 60
Gly Asn Ile Val Leu Thr Tyr Asp Val Glu Tyr Thr Pro Arg Gly Asn
65 70 75 80
Ser Tyr Met Cys Val Tyr Gly Trp Thr Arg Asn Pro Leu Met Glu Tyr
85 90 95
Tyr Ile Val Glu Gly Trp Gly Asp Trp Arg Pro Pro Gly Asn Asp Gly
100 105 110
Glu Val Lys Gly Thr Val Ser Ala Asn Gly Asn Thr Tyr Asp Ile Arg
115 120 125
Lys Thr Met Arg Tyr Asn Gln Pro Ser Leu Asp Gly Thr Ala Thr Phe
130 135 140
Pro Gln Tyr Trp Ser Val Arg Gln Thr Ser Gly Ser Ala Asn Asn Gln
145 150 155 160
Thr Asn Tyr Met Lys Gly Thr Ile Asp Val Ser Lys His Phe Asp Ala
165 170 175
Trp Ser Ala Ala Gly Leu Asp Met Ser Gly Thr Leu Tyr Glu Val Ser
180 185 190
Leu Asn Ile Glu Gly Tyr Arg Ser Asn Gly Ser Ala Asn Val Lys Ser
195 200 205
Val Ser Val
210

<210> 9

<211> 197

<212> PRT

<213> Schizophyllum cimmune

<400> 9

Ser	Gly	Thr	Pro	Ser	Ser	Thr	Gly	Thr	Asp	Gly	Gly	Tyr	Tyr	Tyr	Ser
1				5					10					15	
Trp	Trp	Thr	Asp	Gly	Ala	Gly	Asp	Ala	Thr	Tyr	Gln	Asn	Asn	Gly	Gly
			20					25					30		
Gly	Ser	Tyr	Thr	Leu	Thr	Trp	Ser	Gly	Asn	Asn	Gly	Asn	Leu	Val	Gly
	35						40					45			
Gly	Lys	Gly	Trp	Asn	Pro	Gly	Ala	Ala	Ser	Arg	Ser	Ile	Ser	Tyr	Ser
	50					55					60				
Gly	Thr	Tyr	Gln	Pro	Asn	Gly	Asn	Ser	Tyr	Leu	Ser	Val	Tyr	Gly	Trp
65					70					75					80
Thr	Arg	Ser	Ser	Leu	Ile	Glu	Tyr	Tyr	Ile	Val	Glu	Ser	Tyr	Gly	Ser
				85					90					95	
Tyr	Asp	Pro	Ser	Ser	Ala	Ala	Ser	His	Lys	Gly	Ser	Val	Thr	Cys	Asn
			100					105						110	
Gly	Ala	Thr	Tyr	Asp	Ile	Leu	Ser	Thr	Trp	Arg	Tyr	Asn	Ala	Pro	Ser
		115						120					125		
Ile	Asp	Gly	Thr	Gln	Thr	Phe	Glu	Gln	Phe	Trp	Ser	Val	Arg	Asn	Pro
	130					135					140				
Lys	Lys	Ala	Pro	Gly	Gly	Ser	Ile	Ser	Gly	Thr	Val	Asp	Val	Gln	Cys
145					150					155					160
His	Phe	Asp	Ala	Trp	Lys	Gly	Leu	Gly	Met	Asn	Leu	Gly	Ser	Glu	His
				165					170					175	
Asn	Tyr	Gln	Ile	Val	Ala	Thr	Glu	Gly	Tyr	Gln	Ser	Ser	Gly	Thr	Ala
			180					185						190	
Thr	Ile	Thr	Val	Thr											
				195											

<210> 10

<211> 191

<212> PRT

<213> Streptomyces lividans Xyl B

<400> 10

Asp	Thr	Val	Val	Thr	Thr	Asn	Gln	Glu	Gly	Thr	Asn	Asn	Gly	Tyr	Tyr	1	5	10	15
Tyr	Ser	Phe	Trp	Thr	Asp	Ser	Gln	Gly	Thr	Val	Ser	Met	Asn	Met	Gly	20	25	30	
Ser	Gly	Gly	Gln	Tyr	Ser	Thr	Ser	Trp	Arg	Asn	Thr	Gly	Asn	Phe	Val	35	40	45	
Ala	Gly	Lys	Gly	Trp	Ala	Asn	Gly	Gly	Arg	Arg	Thr	Val	Gln	Tyr	Ser	50	55	60	
Gly	Ser	Phe	Asn	Pro	Ser	Gly	Asn	Ala	Tyr	Leu	Ala	Leu	Tyr	Gly	Trp	65	70	75	80
Thr	Ser	Asn	Pro	Leu	Val	Glu	Tyr	Tyr	Ile	Val	Asp	Asn	Trp	Gly	Thr	85	90	95	
Tyr	Arg	Pro	Thr	Gly	Glu	Tyr	Lys	Gly	Thr	Val	Thr	Ser	Asp	Gly	Gly	100	105	110	
Thr	Tyr	Asp	Ile	Tyr	Lys	Thr	Thr	Arg	Val	Asn	Lys	Pro	Ser	Val	Glu	115	120	125	
Gly	Thr	Arg	Thr	Phe	Asp	Gln	Tyr	Trp	Ser	Val	Arg	Gln	Ser	Lys	Arg	130	135	140	
Thr	Gly	Gly	Thr	Ile	Thr	Thr	Gly	Asn	His	Phe	Asp	Ala	Trp	Ala	Arg	145	150	155	160
Ala	Gly	Met	Pro	Leu	Gly	Asn	Phe	Ser	Tyr	Tyr	Met	Ile	Asn	Ala	Thr	165	170	175	
Glu	Gly	Tyr	Gln	Ser	Ser	Gly	Thr	Ser	Ser	Ile	Asn	Val	Gly	Gly	180	185	190		

<210> 11

<211> 191

<212> PRT

<213> Streptomyces lividans Xyl C

<400> 11

Ala	Thr	Thr	Ile	Thr	Thr	Asn	Gln	Thr	Gly	Thr	Asp	Gly	Met	Tyr	Tyr	1	5	10	15
Ser	Phe	Trp	Thr	Asp	Gly	Gly	Gly	Ser	Val	Ser	Met	Thr	Leu	Asn	Gly	20	25	30	
Gly	Gly	Ser	Tyr	Ser	Thr	Gln	Trp	Thr	Asn	Cys	Gly	Asn	Phe	Val	Ala	35	40	45	

Gly Lys Gly Trp Ser Thr Gly Asp Gly Asn Val Arg Tyr Asn Gly Tyr
50 55 60

Phe Asn Pro Val Gly Asn Gly Tyr Gly Cys Leu Tyr Gly Trp Thr Ser
65 70 75 80

Asn Pro Leu Val Glu Tyr Tyr Ile Val Asp Asn Trp Gly Ser Tyr Arg
85 90 95

Pro Thr Gly Thr Tyr Lys Gly Thr Val Ser Ser Asp Gly Gly Thr Tyr
100 105 110

Asp Ile Tyr Gln Thr Thr Arg Tyr Asn Ala Pro Ser Val Glu Gly Thr
115 120 125

Lys Thr Phe Gln Gln Tyr Trp Ser Val Arg Gln Ser Lys Val Thr Ser
130 135 140

Gly Ser Gly Thr Ile Thr Thr Gly Asn His Phe Asp Ala Trp Ala Arg
145 150 155 160

Ala Gly Met Asn Met Gly Gln Phe Arg Tyr Tyr Met Ile Asn Ala Thr
165 170 175

Glu Gly Tyr Gln Ser Ser Gly Ser Ser Asn Ile Thr Val Ser Gly
180 185 190

<210> 12

<211> 189

<212> PRT

<213> Streptomyces sp. No. 36a

<400> 12

Ala Thr Thr Ile Thr Asn Glu Thr Gly Tyr Asp Gly Met Tyr Tyr Ser
1 5 10 15

Phe Trp Thr Asp Gly Gly Gly Ser Val Ser Met Thr Leu Asn Gly Gly
20 25 30

Gly Ser Tyr Ser Thr Arg Trp Thr Asn Cys Gly Asn Phe Val Ala Gly
35 40 45

Lys Gly Trp Ala Asn Gly Gly Arg Arg Thr Val Arg Tyr Thr Gly Trp
50 55 60

Phe Asn Pro Ser Gly Asn Gly Tyr Gly Cys Leu Tyr Gly Trp Thr Ser
65 70 75 80

Asn Pro Leu Val Glu Tyr Tyr Ile Val Asp Asn Trp Gly Ser Tyr Arg
85 90 95

Pro Thr Gly Glu Thr Arg Gly Thr Val His Ser Asp Gly Gly Thr Tyr
100 105 110

Asp Ile Tyr Lys Thr Thr Arg Tyr Asn Ala Pro Ser Val Glu Ala Pro
115 120 125

Ala Ala Phe Asp Gln Tyr Trp Ser Val Arg Gln Ser Lys Val Thr Ser
130 135 140

Gly Thr Ile Thr Thr Gly Asn His Phe Asp Ala Trp Ala Arg Ala Gly
145 150 155 160

Met Asn Met Gly Asn Phe Arg Tyr Tyr Met Ile Asn Ala Thr Glu Gly
165 170 175

Tyr Gln Ser Ser Gly Ser Ser Thr Ile Thr Val Ser Gly
180 185

<210> 13

<211> 189

<212> PRT

<213> Thermomonospora fusca

<400> 13

Ala Val Thr Ser Asn Glu Thr Gly Tyr His Asp Gly Tyr Phe Tyr Ser
1 5 10 15

Phe Trp Thr Asp Ala Pro Gly Thr Val Ser Met Glu Leu Gly Pro Gly
20 25 30

Gly Asn Tyr Ser Thr Ser Trp Arg Asn Thr Gly Asn Phe Val Ala Gly
35 40 45

Lys Gly Trp Ala Thr Gly Gly Arg Arg Thr Val Thr Tyr Ser Ala Ser
50 55 60

Phe Asn Pro Ser Gly Asn Ala Tyr Leu Thr Leu Tyr Gly Trp Thr Arg
65 70 75 80

Asn Pro Leu Val Glu Tyr Tyr Ile Val Glu Ser Trp Gly Thr Tyr Arg
85 90 95

Pro Thr Gly Thr Tyr Met Gly Thr Val Thr Thr Asp Gly Gly Thr Tyr
100 105 110

Asp Ile Tyr Lys Thr Thr Arg Tyr Asn Ala Pro Ser Ile Glu Gly Thr
115 120 125

Arg Thr Phe Asp Gln Tyr Trp Ser Val Arg Gln Ser Lys Arg Thr Ser
130 135 140

Gly Thr Ile Thr Ala Gly Asn His Phe Asp Ala Trp Ala Arg His Gly
145 150 155 160

Met His Leu Gly Thr His Asp Tyr Met Ile Met Ala Thr Glu Gly Tyr
165 170 175

Gln Ser Ser Gly Ser Ser Asn Val Thr Leu Gly Thr Ser
180 185

<210> 14

<211> 190

<212> PRT

<213> Trichoderma harzanium

<400> 14

Gln Thr Ile Gly Pro Gly Thr Gly Tyr Ser Asn Gly Tyr Tyr Tyr Ser
1 5 10 15
Tyr Trp Asn Asp Gly His Ala Gly Val Thr Tyr Thr Asn Gly Gly Gly
20 25 30
Gly Ser Phe Thr Val Asn Trp Ser Asn Ser Gly Asn Phe Val Gly Gly
35 40 45
Lys Gly Trp Gln Pro Gly Thr Lys Asn Lys Val Ile Asn Phe Ser Gly
50 55 60
Ser Tyr Asn Pro Asn Gly Asn Ser Tyr Leu Ser Ile Tyr Gly Trp Ser
65 70 75 80
Arg Asn Pro Leu Ile Glu Tyr Tyr Ile Val Glu Asn Phe Gly Thr Tyr
85 90 95
Asn Pro Ser Thr Gly Ala Thr Lys Leu Gly Glu Val Thr Ser Asp Gly
100 105 110
Ser Val Tyr Asp Ile Tyr Arg Thr Gln Arg Val Asn Gln Pro Ser Ile
115 120 125
Ile Gly Thr Ala Thr Phe Tyr Gln Tyr Trp Ser Val Arg Arg Asn His
130 135 140
Arg Ser Ser Gly Ser Val Asn Thr Ala Asn His Phe Asn Ala Trp Ala
145 150 155 160
Ser His Gly Leu Thr Leu Gly Thr Met Asp Tyr Gln Ile Val Ala Val
165 170 175
Glu Gly Tyr Phe Ser Ser Gly Ser Ala Ser Ile Thr Val Ser
180 185 190

<210> 15

<211> 178

<212> PRT

<213> Trichoderma ressei Xyl I

Ser Asn

<210> 16

<211> 190

<212> PRT

<213> Trichoderma ressei Xyl II

<400> 16

13

Lys Gly Trp Gln Pro Gly Thr Lys Asn Lys Val Ile Asn Phe Ser Gly
50 55 60

Ser Tyr Asn Pro Asn Gly Asn Ser Tyr Leu Ser Val Tyr Gly Trp Ser
65 70 75 80

Arg Asn Pro Leu Ile Glu Tyr Tyr Ile Val Glu Asn Phe Gly Thr Tyr
85 90 95

Asn Pro Ser Thr Gly Ala Thr Lys Leu Gly Glu Val Thr Ser Asp Gly
100 105 110

Ser Val Tyr Asp Ile Tyr Arg Thr Gln Arg Val Asn Gln Pro Ser Ile
115 120 125

Ile Gly Thr Ala Thr Phe Tyr Gln Tyr Trp Ser Val Arg Arg Asn His
130 135 140

Arg Ser Ser Gly Ser Val Asn Thr Ala Asn His Phe Asn Ala Trp Ala
145 150 155 160

Gln Gln Gly Leu Thr Leu Gly Thr Met Asp Tyr Gln Ile Val Ala Val
165 170 175

Glu Gly Tyr Phe Ser Ser Gly Ser Ala Ser Ile Thr Val Ser
180 185 190

<210> 17

<211> 190

<212> PRT

<213> Trichoderma viride

<400> 17

Gln Thr Ile Gln Pro Gly Thr Gly Phe Asn Asn Gly Tyr Phe Tyr Ser
1 5 10 15

Tyr Trp Asn Asp Gly His Gly Gly Val Thr Tyr Thr Asn Gly Pro Gly
20 25 30

Gly Gln Phe Ser Val Asn Trp Ser Asn Ser Gly Asn Phe Val Gly Gly
35 40 45

Lys Gly Trp Gln Pro Gly Thr Lys Asn Lys Val Ile Asn Phe Ser Gly
50 55 60

Ser Tyr Asn Pro Asn Gly Asn Ser Tyr Leu Ser Val Tyr Gly Trp Ser
65 70 75 80

Arg Asn Pro Leu Ile Glu Tyr Tyr Ile Val Glu Asn Phe Gly Thr Tyr
85 90 95

Asn Pro Ser Thr Gly Ala Thr Lys Leu Gly Glu Val Thr Ser Asp Gly
100 105 110

Ser Val Tyr Asp Ile Tyr Arg Thr Gln Arg Val Asn Gln Pro Ser Ile
115 120 125

Ile Gly Thr Ala Thr Phe Tyr Gln Tyr Trp Ser Val Arg Arg Thr His
130 135 140

Arg Ser Ser Gly Ser Val Asn Thr Ala Asn His Phe Asn Ala Trp Ala
145 150 155 160

Gln Gln Gly Leu Thr Leu Gly Thr Met Asp Tyr Gln Ile Val Ala Val
165 170 175

Glu Gly Tyr Phe Ser Ser Gly Ser Ala Ser Ile Thr Val Ser
180 185 190

<210> 18

<211> 202

<212> PRT

<213> Fibrobacter succinognees

<400> 18

Asn Ser Ser Val Thr Gly Asn Val Gly Ser Ser Pro Tyr His Tyr Glu
1 5 10 15

Ile Trp Tyr Gln Gly Gly Asn Asn Ser Met Thr Phe Tyr Asp Asn Gly
20 25 30

Thr Tyr Lys Ala Ser Trp Asn Gly Thr Asn Asp Phe Leu Ala Arg Val
35 40 45

Gly Phe Lys Tyr Asp Glu Lys His Thr Tyr Glu Glu Leu Gly Pro Ile
50 55 60

Asp Ala Tyr Tyr Lys Trp Ser Lys Gln Gly Ser Ala Gly Gly Tyr Asn
65 70 75 80

Tyr Ile Gly Ile Tyr Gly Trp Thr Val Asp Pro Leu Val Glu Tyr Tyr
85 90 95

Ile Val Asp Asp Trp Phe Asn Lys Pro Gly Ala Asn Leu Leu Gly Gln
100 105 110

Arg Lys Gly Glu Phe Thr Val Asp Gly Asp Thr Tyr Glu Ile Trp Gln
115 120 125

Asn Thr Arg Val Gln Gln Pro Ser Ile Lys Gly Thr Gln Thr Phe Pro
130 135 140

Gln Tyr Phe Ser Val Arg Lys Ser Ala Arg Ser Cys Gly His Ile Asp
145 150 155 160

Ile Thr Ala His Met Lys Lys Trp Glu Glu Leu Gly Met Lys Met Gly
165 170 175

Lys Met Tyr Glu Ala Lys Val Leu Val Glu Ala Gly Gly Gly Ser Gly
180 185 190

Ser Phe Asp Val Thr Tyr Phe Lys Met Thr
195 200

<210> 19

<211> 189

<212> PRT

<213> Asparigillus awamori var. kawachi

<400> 19

Arg Ser Thr Pro Ser Ser Thr Gly Glu Asn Asn Gly Tyr Tyr Tyr Ser
1 5 10 15

Phe Trp Thr Asp Gly Gly Gly Asp Val Thr Tyr Thr Asn Gly Asn Ala
20 25 30

Gly Ser Tyr Ser Val Glu Trp Ser Asn Val Gly Asn Phe Val Gly Gly
35 40 45

Lys Gly Trp Asn Pro Gly Ser Ala Lys Asp Ile Thr Tyr Ser Gly Asn
50 55 60

Phe Thr Pro Ser Gly Asn Gly Tyr Leu Ser Val Tyr Gly Trp Thr Thr
65 70 75 80

Asp Pro Leu Ile Glu Tyr Tyr Ile Val Glu Ser Tyr Gly Asp Tyr Asn
85 90 95

Pro Gly Ser Gly Gly Thr Thr Arg Gly Asn Val Ser Ser Asp Gly Ser
100 105 110

Val Tyr Asp Ile Tyr Thr Ala Thr Arg Thr Asn Ala Pro Ser Ile Asp
115 120 125

Gly Thr Gln Thr Phe Ser Gln Tyr Trp Ser Val Arg Gln Asn Lys Arg
130 135 140

Val Gly Gly Thr Val Thr Thr Ser Asn His Phe Asn Ala Trp Ala Lys
145 150 155 160

Leu Gly Met Asn Leu Gly Thr His Asn Tyr Gln Ile Leu Ala Thr Glu
165 170 175

Gly Tyr Gln Ser Ser Gly Ser Ser Ser Ile Thr Ile Gln
180 185

<210> 20

<211> 194

<212> PRT

<213> Thermomyces lanuginosus

<400> 20

Gln	Thr	Thr	Pro	Asn	Ser	Glu	Gly	Trp	His	Asp	Gly	Tyr	Tyr	Tyr	Ser	1	5	10	15
Trp	Trp	Ser	Asp	Gly	Gly	Ala	Gln	Ala	Thr	Tyr	Thr	Asn	Leu	Glu	Gly	20	25	30	
Gly	Thr	Tyr	Glu	Ile	Ser	Trp	Gly	Asp	Gly	Gly	Asn	Leu	Val	Gly	Gly	35	40	45	
Lys	Gly	Trp	Asn	Pro	Gly	Leu	Asn	Ala	Arg	Ala	Ile	His	Phe	Glu	Gly	50	55	60	
Val	Tyr	Gln	Pro	Asn	Gly	Asn	Ser	Tyr	Leu	Ala	Val	Tyr	Gly	Trp	Thr	65	70	75	80
Arg	Asn	Pro	Leu	Val	Glu	Tyr	Tyr	Ile	Val	Glu	Asn	Phe	Gly	Thr	Tyr	85	90	95	
Asp	Pro	Ser	Ser	Gly	Ala	Thr	Asp	Leu	Gly	Thr	Val	Glu	Cys	Asp	Gly	100	105	110	
Ser	Ile	Tyr	Arg	Leu	Gly	Lys	Thr	Thr	Arg	Val	Asn	Ala	Pro	Ser	Ile	115	120	125	
Asp	Gly	Thr	Gln	Thr	Phe	Asp	Gln	Tyr	Trp	Ser	Val	Arg	Gln	Asp	Lys	130	135	140	
Arg	Thr	Ser	Gly	Thr	Val	Gln	Thr	Gly	Cys	His	Phe	Asp	Ala	Trp	Ala	145	150	155	160
Arg	Ala	Gly	Leu	Asn	Val	Asn	Gly	Asp	His	Tyr	Tyr	Gln	Ile	Val	Ala	165	170	175	
Thr	Glu	Gly	Tyr	Phe	Ser	Ser	Gly	Tyr	Ala	Arg	Ile	Thr	Val	Ala	Asp	180	185	190	
Val	Gly																		

<210> 21

<211> 76

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<223> Trx-1

<400> 21
ctagctaagg aggctgcaga tgcaaacaat acaaccagga accggttaca acaacggtta 60
cttttacagc tattgg 76

<210> 22

<211> 78

<212> DNA

<213> Artificial Sequence

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<223> XyTv-2

<400> 22
aacgatggcc atggtggtgt tacctataca aacggggcccg gaggcccaatt tagcgtcaat 60
tggtctaact ccggaaac 78

<210> 23

<211> 78

<212> DNA

<213> Artificial Sequence

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<223> Trx-3

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tcttataatc cgaatggg 78

<210> 24

<211> 74

<212> DNA

<213> Artificial Sequence

<220>

<223> XyTv-4

<400> 24
aattcatact taagcgtcta tggctggtct agaaacccac tgattgaata ttacattgtc 60
gaaaatttcg gtac 74

<210> 25

<211> 51

<212> DNA

<213> Artificial Sequence

<220>

<223> Trx-8

<400> 25
gattcctccg acgtctacgt ttgttatggt ggtccttggc caatgttggt g 51

<210> 26

<211> 84

<212> DNA

<213> Artificial Sequence

<220>

<223> XyTv-7

<400> 26
ccaatgaaaa tgtcgataac cttgctaccg gtaccaccac aatggatatg tttgcccggg 60

cctccgggta aatcgcagtt aacc 84

<210> 27

<211> 78

<212> DNA

<213> Artificial Sequence

<220>

<223> Trx-6

<400> 27
agattgaggc ctttgaagca tccacctttt ccaaccgttg ggccctgggtt tttattccac 60
tagttgaaga gacctaga 78

<210> 28

<211> 85

<212> DNA

<213> Artificial Sequence

<220>

<223> XyTv-5

<400> 28
atattaggct tacccttaag tatgaattcg cagataccga ccagatcttt gggtgactaa 60
cttataatgt aacagctttt aaagc 85

<210> 29

<211> 58

<212> DNA

<213> Artificial Sequence

<220>

<223> XyTv-101

<400> 29
tcgacaattt cggtacctac aatccgagta ccggcgccac aaaattaggc gaagtcac 58

<210> 30

<211> 53

<212> DNA

<213> Artificial Sequence

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<223> XyTv-102

<400> 30
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<210> 31

<211> 59

<212> DNA

<213> Artificial Sequence

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<223> Trx-103

<400> 31
cgatcattgg aaccgccacc ttttatcagt actggagtgt tagacgtaat catcggagc 59

<210> 32

<211> 69

<212> DNA

<213> Artificial Sequence

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<223> XyTv-104

<400> 32
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ggtacaatg 69

<210> 33

<211> 67

<212> DNA

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<223> XyTv-105

<400> 33
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agctaaa 67

<210> 34

<211> 73

<212> DNA

<213> Artificial Sequence

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<223> XyTv-110

<400> 34

gttaaagcca tggatgtag gctcatggcc gcggtgtttt aatccgcttc agtgatcact 60

acctaggcat ata 73

<210> 35

<211> 54

<212> DNA

<213> Artificial Sequence

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<223> XyTv-109

<400> 35

ctatagatgg catgggttgc gcaattagtc ggtagctagt aaccttggcg gtgg 54

<210> 36

<211> 60

<212> DNA

<213> Artificial Sequence

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<223> XyTv-108

<400> 36

aaaatagtca tgacctcaca atctgcatta gtagcctcga ggccaagcca attatgacgc 60

<210> 37

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<212> DNA

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<220>

<223> XyTv-107

<400> 37
ttagtgaaat tacgtacccg tgctggtccc aattgggatc catgttacct aatagtttag 60
catcgc 66

<210> 38

<211> 53

<212> DNA

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<220>

<223> XyTv-106

<400> 38
caccttccga tgaagagctc accaaggcga tcataatgtc actcgatttc tag 53

<210> 39

<211> 596

<212> DNA

<213> Artificial Sequence

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<400> 39
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cttttacagc tattggaacg atggccatgg tgggtgttacc tatacaaacg ggcccggagg 120
ccaatttagc gtcaattggg tcaactccgg aaacttcgta ggtggaaaag gttggcaacc 180
cgggaccaaa aataagggtga tcaacttctc tggatcttat aatccgaatg ggaattcata 240
cttaagcgtc tatggctggg ctagaaaccc actgattgaa tattacattg tcgaaaattt 300
cggtacctac aatccgagta ccggcgccac aaaattaggc gaagtcacta gtgatggatc 360
cgtatatgat atctaccgta cccaacgggt taatcagcca tcgatcattg gaaccgccac 420
cttttatcag tactggagtg ttagacgtaa tcatcgagc tccgggtcgg ttaatactgc 480

gaatcacttt aatgcatggg cacagcaagg gttaacccta ggtacaatgg attatcaaat 540
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<210> 40

<211> 36

<212> DNA

<213> Artificial Sequence

<220>

<223> Tx-75A-1

<400> 40
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<210> 41

<211> 42

<212> DNA

<213> Artificial Sequence

<220>

<223> Tx-105H-1

<400> 41
accggcgcca caaaacacgg cgaagtcact agtgatggat cc 42

<210> 42

<211> 44

<212> DNA

<213> Artificial Sequence

<220>

<223> Tx-C1

<400> 42
ccaaggcgat cataatgtca ctcgatttct agaacttcga accc 44

<210> 43

<211> 36

<212> DNA

<213> Artificial Sequence

<220>

<223> Tx-del(123-144)-1r

<400> 43

cggagctccg acgcgttggg tacggtagat atcata

36

<210> 44

<211> 42

<212> DNA

<213> Artificial Sequence

<220>

<223> Tx-105R-1

<400> 44

accggcgcca caaaaagagg cgaagtcact agtgatggat cc

42

<210> 45

<211> 41

<212> DNA

<213> Artificial Sequence

<220>

<223> Tx-N1

<400> 45

ctagctaagg aggctgcaga tgcaaacaat acaaccagga a

41

<210> 46

<211> 36

<212> DNA

<213> Artificial Sequence

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<223> Tx-75-G1

<400> 46
tgggaattca tacttaggcg tctatggctg gtctag

36

<210> 47

<211> 66

<212> DNA

<213> Artificial Sequence

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<223> Tx-144R-1r

<400> 47
ccatgcatta aagtgattcg cagtattaac cgaaccggag ctccgacgat tacgtctaac

60

actcca

66

<210> 48

<211> 44

<212> DNA

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<220>

<223> Tx-161R-1r

<400> 48
gtacctaggg ttaacccttg ccgtgcccac gcattaaagt gatt

44

<210> 49

<211> 40

<212> DNA

<213> Artificial Sequence

<220>

<223> Tx-125A 129E-1

<400> 49
ccaacgcggtt aatgcgccat cgatcgaggg aaccgccacc 40

<210> 50

<211> 26

<212> DNA

<213> Artificial Sequence

<220>

<223> Tx-116G-1

<400> 50
gacggatccg tatatggtat ctaccg 26

<210> 51

<211> 36

<212> DNA

<213> Artificial Sequence

<220>

<223> Tx-118C-1

<400> 51
gacggatccg tatatgatat ctgccgtacc caacgc 36

<210> 52

<211> 39

<212> DNA

<213> Artificial Sequence

<220>

<223> Tx-10H11D-1

<400> 52
ggaaccggtt accacgacgg ttactttttac agctattgg 39

<210> 53

<211> 36

<212> DNA

<213> Artificial Sequence

<220>

<223> Tx-116G118C-1

<400> 53
gacggatccg tatatggtat ctgccgtacc caacgc

36

<210> 54

<211> 184

<212> PRT

<213> Aspergillus kawachii

<400> 54

Ser	Ala	Gly	Ile	Asn	Tyr	Val	Gln	Asn	Tyr	Asn	Gly	Asn	Leu	Ala	Asp	1	5	10	15
Phe	Thr	Tyr	Asp	Glu	Ser	Ala	Gly	Thr	Phe	Ser	Met	Tyr	Trp	Glu	Asp	20	25	30	
Gly	Val	Ser	Ser	Asp	Phe	Val	Val	Gly	Leu	Gly	Trp	Thr	Thr	Gly	Ser	35	40	45	
Ser	Asn	Ala	Ile	Ser	Tyr	Ser	Ala	Glu	Tyr	Ser	Ala	Ser	Gly	Ser	Ser	50	55	60	
Ser	Tyr	Leu	Ala	Val	Tyr	Gly	Trp	Val	Asn	Tyr	Pro	Gln	Ala	Glu	Tyr	65	70	75	80
Tyr	Ile	Val	Glu	Asp	Tyr	Gly	Asp	Tyr	Asn	Pro	Cys	Ser	Ser	Ala	Thr	85	90	95	
Ser	Leu	Gly	Thr	Val	Tyr	Ser	Asp	Gly	Ser	Thr	Tyr	Gln	Val	Cys	Thr	100	105	110	
Asp	Thr	Arg	Thr	Asn	Glu	Pro	Ser	Ile	Thr	Gly	Thr	Ser	Thr	Phe	Thr	115	120	125	
Gln	Tyr	Phe	Ser	Val	Arg	Glu	Ser	Thr	Arg	Thr	Ser	Gly	Thr	Val	Thr	130	135	140	
Val	Ala	Asn	His	Phe	Asn	Phe	Trp	Ala	Gln	His	Gly	Phe	Gly	Asn	Ser	145	150	155	160
Asp	Phe	Asn	Tyr	Gln	Val	Met	Ala	Val	Glu	Ala	Trp	Ser	Gly	Ala	Gly	165	170	175	

Ser Ala Ser Val Thr Ile Ser Ser
180

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<211> 190

<212> PRT

<213> Artificial Sequence

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<223> TrX-H-11D-ML-75A105H-118C-125A129E-144R161R (TrX-H-11D-ML-AHCAE-RR)

<400> 55

Gln Thr Ile Gln Pro Gly Thr Gly Tyr His Asp Gly Tyr Phe Tyr Ser
1 5 10 15

Tyr Trp Asn Asp Gly His Gly Gly Val Thr Met Thr Leu Gly Pro Gly
20 25 30

Gly Gln Phe Ser Val Asn Trp Ser Asn Ser Gly Asn Phe Val Gly Gly
35 40 45

Lys Gly Trp Gln Pro Gly Thr Lys Asn Lys Val Ile Asn Phe Ser Gly
50 55 60

Ser Tyr Asn Pro Asn Gly Asn Ser Tyr Leu Ala Val Tyr Gly Trp Ser
65 70 75 80

Arg Asn Pro Leu Ile Glu Tyr Tyr Ile Val Glu Asn Phe Gly Thr Tyr
85 90 95

Asn Pro Ser Thr Gly Ala Thr Lys His Gly Glu Val Thr Ser Asp Gly
100 105 110

Ser Val Tyr Asp Ile Cys Arg Thr Gln Arg Val Asn Ala Pro Ser Ile
115 120 125

Glu Gly Thr Ala Thr Phe Tyr Gln Tyr Trp Ser Val Arg Arg Asn Arg
130 135 140

Arg Ser Ser Gly Ser Val Asn Thr Ala Asn His Phe Asn Ala Trp Ala
145 150 155 160

Arg Gln Gly Leu Thr Leu Gly Thr Met Asp Tyr Gln Ile Val Ala Val
165 170 175

Glu Gly Tyr Phe Ser Ser Gly Ser Ala Ser Ile Thr Val Ser
180 185 190

<210> 56

<211> 112

<212> DNA

<213> Artificial Sequence

<220>

<223> TrX-HML

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<210> 57

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> TrX-HML

<400> 57

Gln Thr Ile Gln Pro Gly Thr Gly Tyr His Asn Gly Tyr Phe Tyr Ser
1 5 10 15

Tyr Trp Asn Asp Gly His Gly Gly Val Thr Met Thr Leu Gly
20 25 30

<210> 58

<211> 14

<212> PRT

<213> Artificial Sequence

<220>

<223> TX-105R-1

<400> 58

Thr Gly Ala Thr Lys Arg Gly Glu Val Thr Ser Asp Gly Ser
1 5 10

<210> 59

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> TX-C1

<400> 59

Gly Ser Ala Ser Ile Thr Val Ser
1 5

<210> 60

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> TX-75A-1

<400> 60

Asn Gly Asn Ser Tyr Leu Ala Val Tyr Gly Trp Ser Arg
1 5 10

<210> 61

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> TX-75G-1

<400> 61

Asn Gly Asn Ser Tyr Leu Gly Val Tyr Gly Trp Ser Arg
1 5 10

<210> 62

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> TX125A129E-1

<400> 62

Gln Arg Val Asn Ala Pro Ser Ile Glu Gly Thr Ala Thr
1 5 10

<210> 63

<211> 14

<212> PRT

<213> Artificial Sequence

<220>

<223> TX-105H-1

<400> 63

Thr Gly Ala Thr Lys His Gly Glu Val Thr Ser Asp Gly Ser
1 5 10

<210> 64

<211> 12

<212> PRT

<213> Artificial Sequence

<220>

<223> TX-del (123-144)-1r

<400> 64

Gly Ser Ser Arg Arg Gln Thr Arg Tyr Ile Asp Tyr
1 5 10

<210> 65

<211> 7

<212> PRT

<213> Artificial Sequence

<220>

<223> TX-N1

<400> 65

Gln Thr Ile Gln Pro Gly Thr
1 5

<210> 66

<211> 22

<212> PRT

<213> Artificial Sequence

<220>

<223> TX-144R-1r

<400> 66

Trp Ala Asn Phe His Asn Ala Thr Asn Val Ser Gly Ser Ser Arg Arg
1 5 10 15

Asn Arg Arg Val Ser Trp
20

<210> 67

<211> 15

<212> PRT

<213> Artificial Sequence

<220>

<223> TX-161R-1r

<400> 67

Thr Gly Leu Thr Leu Gly Gln Arg Ala Trp Ala Asn Phe His Asn
1 5 10 15

<210> 68

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> TX-116G-1

<400> 68

Asp Gly Ser Val Tyr Gly Ile Tyr Arg
1 5

<210> 69

<211> 12

<212> PRT

<213> Artificial Sequence

<220>

<223> TX-118C-1

<400> 69

Asp Gly Ser Val Tyr Asp Ile Cys Arg Thr Gln Arg
1 5 10

<210> 70

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> TX-10H11D-1

<400> 70

Gly	Thr	Gly	Tyr	His	Asp	Gly	Tyr	Phe	Tyr	Ser	Tyr	Trp
1				5					10			

<210> 71

<211> 12

<212> PRT

<213> Artificial Sequence

<220>

<223> TX-116G118C-1

<400> 71

Asp	Gly	Ser	Val	Tyr	Gly	Ile	Cys	Arg	Thr	Gln	Arg
1				5					10		